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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Baking Machinery

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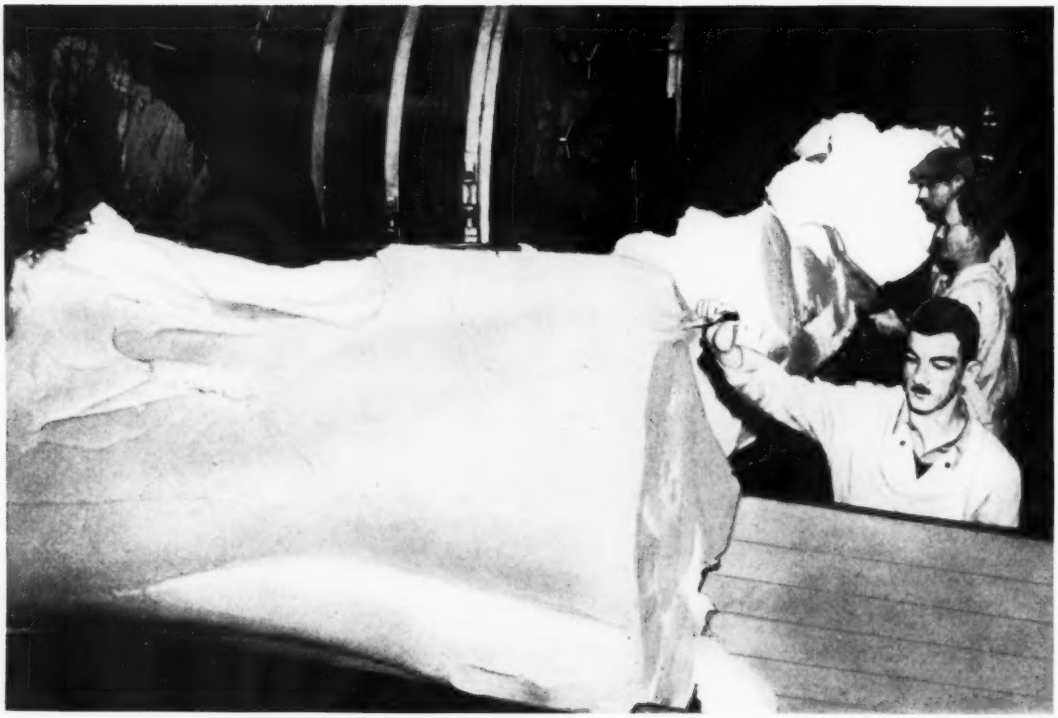

BREAD "SPREAD"

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LUBRICATION

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Vol. XXX October, 1944 No. 10

Change of Address: In reporting change of address kindly give both old and new addresses.

Baking Machinery

DEVELOPMENT of the art of baking has paralleled the development of civilization. Ever since man discovered the food value of grain cereals, cooking by dry heat has been practiced to make them more palatable. Bread became one of the chief components in the diet of the average man. History and travel divulges that cereal flour baked into bread is variously identified; viz: the "tortillas" or corn cakes of Central America which are baked on an iron plate; the wheat flour "chappates" of India, which are baked on a griddle over hot coals; the oat cake of Scotland; the barley meal bread of Norway and the "cassava" bread of the West Indies.

Statistics also are of interest. Approximately one-third of the food consumed by the world consists of grains, three-fourths of which are estimated as being in the form of wheat bread. The relative cost is around one-tenth of the total cost of subsistence. Bread certainly is indispensable.

Baking became a mass production industry quite naturally, as civilization progressed and distribution facilities were perfected. As such it became highly mechanized and definitely related to lubrication. From the time the flour is received in the shop till the finished loaf of bread is ready for sale, practically all handling and every intermediate process is performed mechanically.

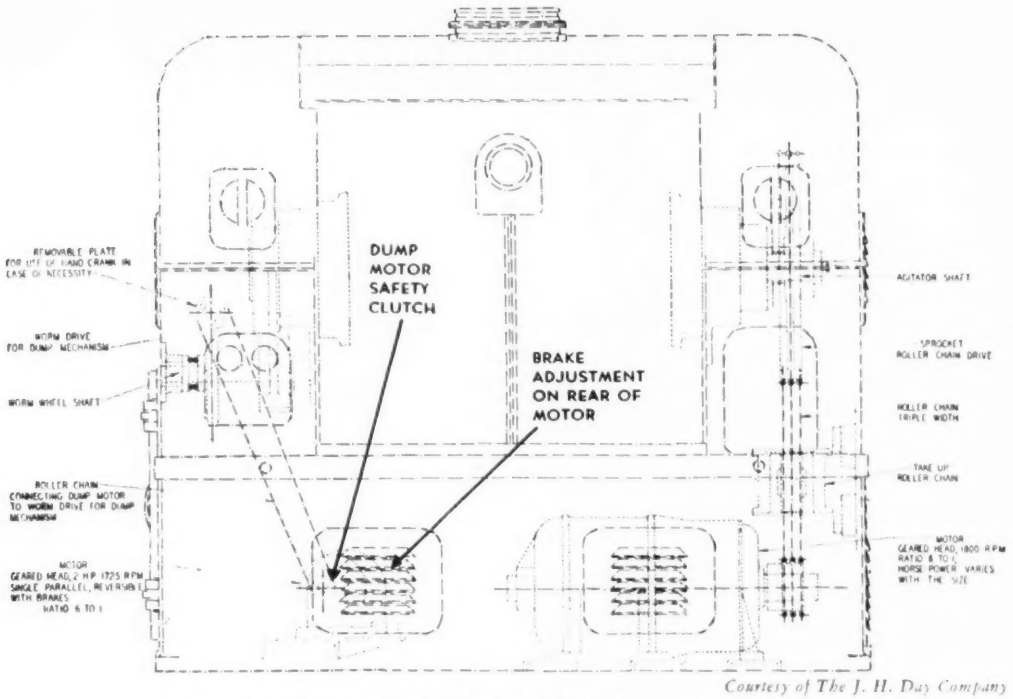
THE most highly perfected methods of automatic lubrication are found in the modern bakery. The machinery of baking is comparatively high speed. Some units are subject to a certain amount of dust, and in the operation of traveling oven mechanisms lubricants must be chosen from the viewpoint of their heat resisting ability.

It is most important to prevent contamination of materials by lubricants; also contamination of lubricants by flour. Manufacturers of the machinery employed have fully realized these essentials, a fact which justifies most careful selection of lubricants and their usage in such a manner as to insure the longest possible life of the operating parts.

The purity or quality of the products depend to a marked extent upon the manner of lubrication and the grades of lubricants in use. Careless or sloppy application of the latter, or the use of inferior grades may frequently cause the ruination of otherwise perfect products due to spilling or dripping of oil or grease thereupon.

So, the modern bakery, to successfully compete with the trade and comply with pure food laws must practically guarantee that its products are of the highest purity. To uphold this guarantee it must use only the finest grades of lubricants, applying same in the most careful manner to insure that they will not contaminate the bread, cake or pies in any way whatsoever.

Proper application, however, is not enough. Even with the best of lubricants and regardless of the care in usage, in certain processes there will be possibility of the lubricant coming in contact with the products. A poorly refined oil might easily so



Courtesy of The J. H. Day Company

Fig. 1—Drive view of a Day Hercules Type "B" dough mixer showing details of the operating mechanisms.

discolor the dough or involve the presence of certain ingredients as to require the discard of the entire batch. In addition, the lubricants must be suitable for the operating conditions in order that the utmost economy and efficiency may be gained and the plant kept operating at maximum capacity.

SIFTING AND BOLTING

Flour handling is necessary, incident to any baking operation; it begins with sifting and bolting. This is necessary after flour is received in the bakery, even though it may have been subjected to the same treatment in the mill, for all impurities or lint which it may have gathered during handling or transit must be removed. The cone sifter or bolting reel is used for this purpose. Blending and aerating is also accomplished at the same time. Sifting or bolting effectively breaks up any lumps or compact masses which may have formed in the sacks. This treatment enables the baker to produce a smooth, high grade dough.

THE MIXER

Production demands have necessitated considerable study of speed in mixing operations. Today mixing is done at varying speeds according to the type of dough being handled. High speed mixing is preferred for regular bread dough; it is regarded as more thorough, the gluten is better developed, and the texture, color and absorption are materially improved. Inasmuch as the fermentation period is also decreased by the use of a high speed machine, more of the desirable ingredients are retained and slacking is prevented.

Flour and other necessary ingredients of the dough, such as water, milk, yeast, salt, malt and shortening may be added directly to the mixer in measured quantities or mixed before-hand in a so-called ingredient mixer. This auxiliary is becoming popular in modern practice because the thorough preliminary mixing of these substances tends to a more uniform loaf of better texture. In addition, labor and time for mixing is materially reduced. Such a mixer is also used to advantage in dissolving yeast in water, mixing other yeast foods, pastry and sweet goods.

The texture of some doughs may cause abnormal temperatures to develop as the speed of the mixer is increased. This can be counteracted by providing a cooling jacket around the bowl through which water or refrigerant can be circulated; or, blowing a steady current of cold, dry air into the mixture through the mixing arms. When air is used it should be suitably filtered and washed to absolute purity. Motor driven blowers deliver the air at about 80°F., through sealed ducts. It is claimed that when air cooling is used the oxygen bleaches the dough, and yeast action is accelerated. The time required for

mixing will vary from 8 to 15 minutes, depending on the type of machine used, and the grade of the flour. Naturally the lower the mixing period the greater will be the efficiency and rate of production; also, the lower will be the power consumption per batch.

Construction Requirements

Mixers differ in construction, chiefly in the arrangement of the blades or arms, the driving mechanism and method of dough discharge. The ultimate objectives are the same: i.e.

1. The dough should be rolled, pulled and stretched by the arms so as to develop the gluten to the greatest extent, with no cutting or tearing.
2. There should be no joints or bearings to come in contact with the dough, and the trunnion bearings should be entirely separate from trough ends.
3. Mixing arms should be designed (using hollow centers as some manufacturers advise) so that the dough will not wad thereupon, but fall through easily.

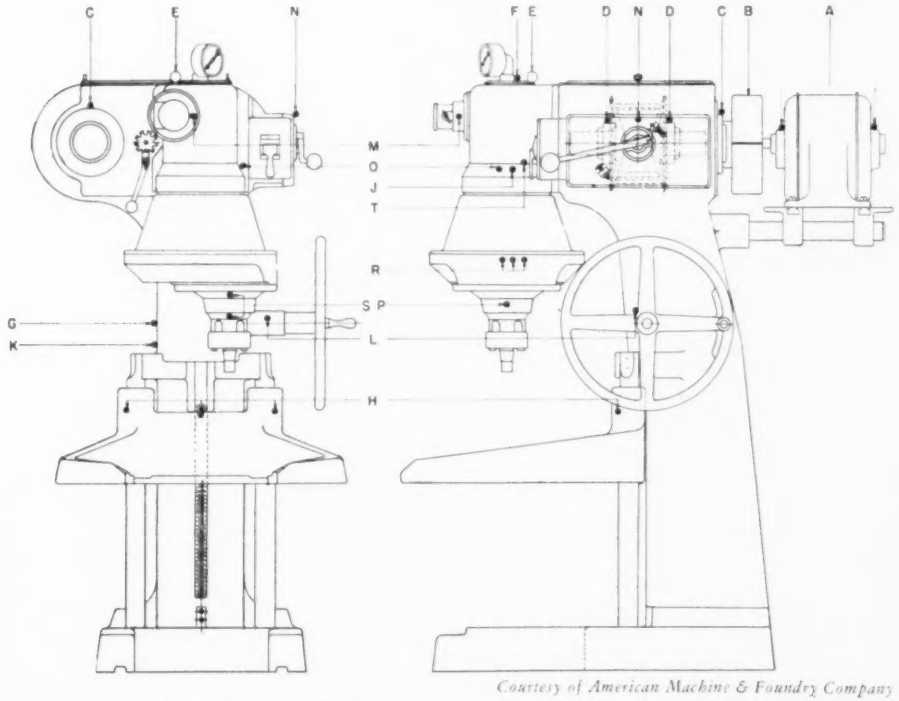
   The machine should be self-cleaning and no dry or unmixed ingredients should be able to collect on the mixing blades or interior of the bowl.
4. All driving and operating gears, chains, etc., should be completely enclosed.
5. The edge of the blades should act as a knife to keep the bowl scraped clean, and
6. The frame should be rigid, to insure smooth operation without vibration.

THE DIVIDER

From the mixer, following the period for fermentation the dough is delivered in bulk, usually by gravity via a chute to the feed hopper of the divider. This machine divides the dough mechanically, scaling it to loaves of desired size and weight without variation. The divider was developed to supplant the old method of scaling loaves by hand, which was slow, unsatisfactory and often led to considerable loss due to overweight.

How It Works

The modern divider will vary in construction, although the same principles hold true in all. In one type of machine the dough, as fed from the hopper, is periodically cut by a steel knife, the portions being carried by gravity and suction into the cut-off box. Here, enclosed on all sides, it is carried forward by a reciprocating piston to fill each of the rotating cylinder pockets with the desired quantity. The cylinder then automatically makes half a revolution, the dough in the pockets being cut cleanly from the mass contained in the cut-off box, and delivered to the working table or to a con-



Courtesy of American Machine & Foundry Company

Fig. 2—Lubrication chart for an AMF 2B Glen mixer. Points A and B require oil once every 3 months. Point C should be greased monthly. Point E requires transmission oil, the level being checked monthly. Points D through R require grease lubrication by pressure gun once every 3 months. S and T are drain plugs.

veyor which delivers it to the rounder.

Another type of divider carries the dough from the hopper by a pair of adjustable rollers to a feeding chamber in which a reciprocating feeder operates. The dough is then pushed into a cylindrical plunger chamber at one side of the feed chamber by a cutter plate, and cut from the mass in the hopper. A plunger then carries the dough forward into one or more opposed chambers in a revolving measuring head. Movable followers in the bottoms of these chambers eject the dough as measured.

The desired weight of the loaves may be obtained without stopping the machine, by hand screw and worm adjustment to operate the followers exactly to the same extent. Gearing and suitable cam and connecting rod arrangements constitute the operating mechanisms.

Dividers are largely motor driven requiring from one to five h.p. depending on their weight and capacity. Measuring devices may contain from one to eight pockets, with a capacity of from 1,500 to 9,600 loaves of the usual weights per hour. Whatever the type of machine, there should be no inaccessible crevices to retain dough, otherwise there would be possibility of mould and rancidity occuring.

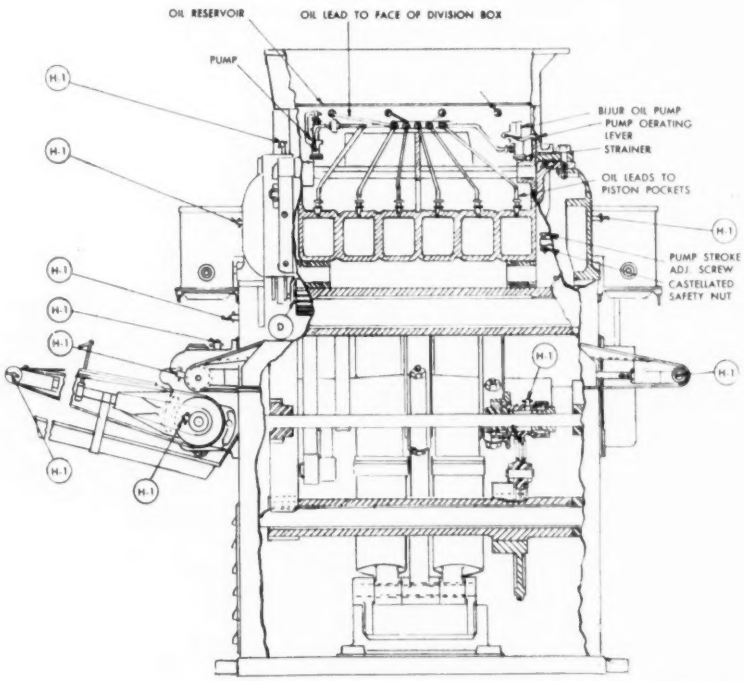
THE ROUNDER

The rounder simulates the action of the hands in rounding each individual piece and preventing the escape of gas from the cut ends. Rounding is done in flour or in the presence of air currents to dry the surface and cause the formation of a protecting skin.

The development of the rounder came as a logical sequence to the divider, for, after dividing the dough automatically, it was essential to have a machine that would quite as rapidly round or ball up the pieces and at the same time coat them with the required covering or membrane.

All this is accomplished by means of a kneading drum which rolls the pieces of dough around a conical shaped surface, or by the combination of a revolving conical table and spiral trough. In this way the pieces as received from the divider by traveling belt are rolled around in all directions to give them a perfectly spherical shape. At the same time, the cut ends are completely balled up, so there is little or no need for dusting with flour prior to subsequent delivery to the proofer. The small rounder will handle up to the capacity of a 4-pocket divider; large rounders handle up to the capacity of an 8-pocket divider. Rolls and buns require a separate machine.

A suitable flour duster may be installed with a regulator and delivery chute to control the rate at which the flour is used by the rounder. A "flour catch" is also necessary to prevent dusting flour from falling to the floor.



Courtesy of Baker Perkins, Inc.

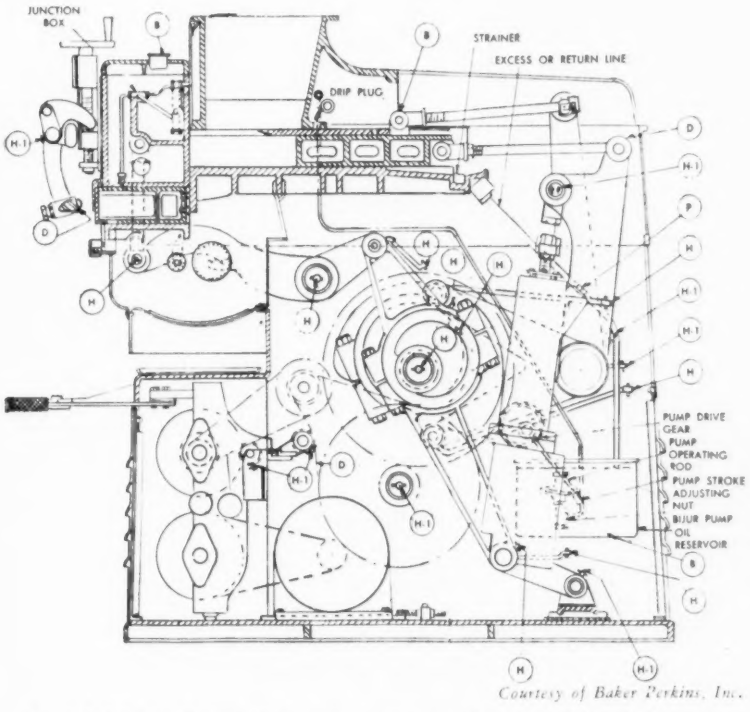
Fig. 3—Lubrication diagram (Front view) for a B.P. 6-pocket dough divider showing parts to be lubricated and details of the Bijur oiling system for the division box. "B" calls for special "Divider" oil; "D" requires light straight mineral oil every 8 hours; "E" requires steam cylinder oil in the bath; "H" signifies pressure gun grease every 4 hours; "H-1" calls for pressure gun grease every 8 hours; "P" calls for heavy lubricating oil (SAE 30); drain and refill every 6 months.

THE PROOFER

After the dough has left the rounder it must "rest" in the proofer before it is delivered to the moulder. This treatment is commonly known as the preliminary proof. It may take from 8 to 15 minutes according to the type of dough. There are various types of proofers on the market, involving automatic bucket or belt conveyors, rotary motion, or simply stationary trays. The loaves are carried backward and forward by the conveying mechanism at such a speed that each will remain in the proofer

the desired length of time; then they are delivered by chute and hopper to the moulder.

The automatic bucket or belt proofer, requires a spacer which delivers each loaf as received from the rounder to an individual container in the proofer. The spacer is simply a rotating compartment wheel, operating in connection with an incline built with drop bottom sections. These are set to open in sequence and deliver each contained loaf to a corresponding chamber on the proofer conveyor as it passes by.



Courtesy of Baker Perkins, Inc.

Fig. 4—Lubrication diagram (Side view) for a B.P. 6-pocket dough divider showing parts to be lubricated and details of the Bijur oiling system for the division box. "B" calls for special "Divider" oil; "D" requires light straight mineral oil every 8 hours; "E" requires steam cylinder oil in the bath; "H" signifies pressure gun grease every 4 hours; "H-1" calls for pressure gun grease every 8 hours; "P" calls for heavy lubricating oil (SAE 30); drain and refill every 6 months.

THE MOULDER

Final treatment and shaping of the loaves prior to baking is performed by the moulder. This machine is a most important piece of mechanism. By its use each piece is subjected to the same handling to give uniform shape and texture, the kneading pressure is uniform, and exactly proportioned to the delicacy of the substance handled; it can materially influence the production of the bakery as a whole.

As each loaf comes from the proofer, it passes into a feed hopper, being led to a series of rolls which flatten it, cause the escape of part of the gases and evenly distribute the remainder. This sheet of dough is then coiled in a spiral shape to whiten and aerate it, and also produce a uniform close grain. The coil then passes to a drum where it is kneaded and rolled, and a thin skin formed over the entire surface prior to discharge. Each piece of dough is in continuous motion throughout the machine; there is no chance of contact with each other, nor is there any chance for mangling.

Quite naturally there are differences in moulder design depending on the size of loaves or output required. The principles of operation, however, are same.

Mechanical moulding possesses many advantages over hand moulding. For example, a motor-driven mechanical moulder will enable far greater unit output, delivering with exact uniformity as high as 7,200 loaves per hour. Hand operation will average from 350 to 500 loaves per hour.

The amount of dusting flour used is greatly reduced; sometimes it is not even necessary. Working conditions are, therefore, far more healthful, for fine dust in the air is largely eliminated, and much greater cleanliness is assured.

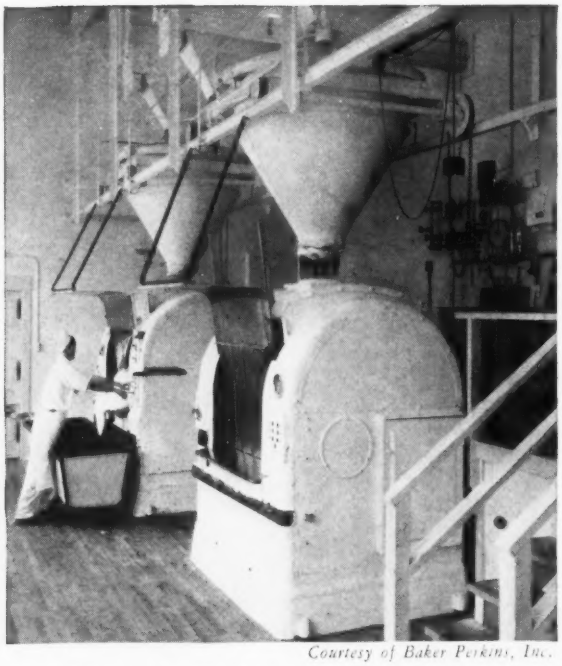
Loaves are more uniform in size; better shaped; and there is but little possibility of discoloration in the crumb or top crust on account of excess dusting flour.

Manual labor is reduced, hence the energy of the baker is conserved and he is able to use his best efforts in the operation of the machines so as to obtain maximum output.

PAN-PROOFING

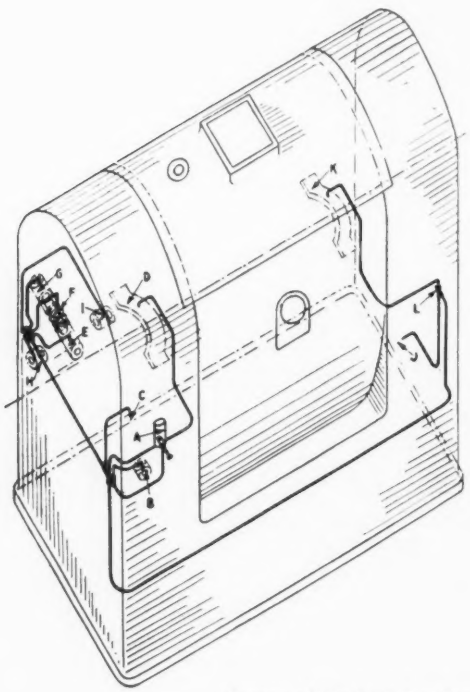
A second period of proofing is applied to the dough in the baking pans after it leaves the moulder. In the industry this is known as the "rising" period. Pan-proofers (or steam chests as they are sometimes termed) are essentially wood or metal compartments, with shelves or conveyors installed for holding the pans, or built so that wheeled shelf carriers may be rolled in bodily.

The temperature and humidity are important in pan-proofing. Both must be maintained constant and definitely controlled; otherwise the bread will crust abnormally or be inferior in appearance and



Courtesy of Baker Perkins, Inc.

Fig. 5—Self-Cleaning sifters, flour scales, and automatic flow control, installed in connection with stationary bowl dough mixers.



Courtesy of The J. H. Day Company

Fig. 6—One shot lubrication on a Day Hercules Type "B" dough mixer.

A—Pump and Reservoir
B—Worm Shaft Bearing (Front)
C—Dump Chain
D—Tank Trunnion Bearing (Left)
E—Worm Shaft Bearing (Center)
F—Worm
G—Worm Shaft Bearing (Rear)
H—Worm Wheel (Left)
I—Worm Wheel (Right)
J—Automatic Take-Up
K—Tank Trunnion Bearing (Right)
L—Air Vent

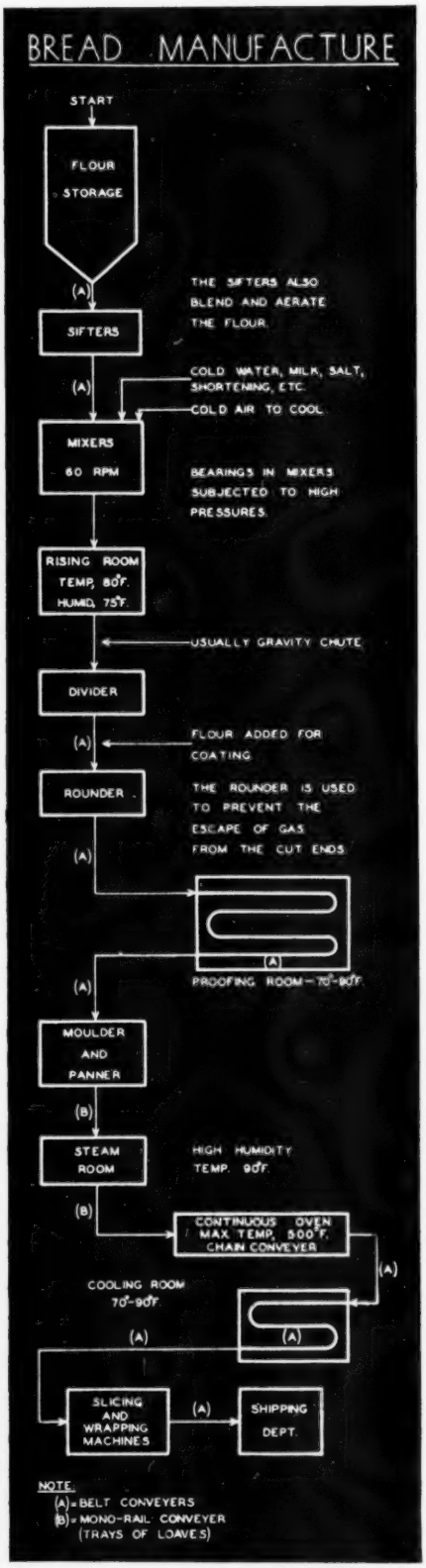
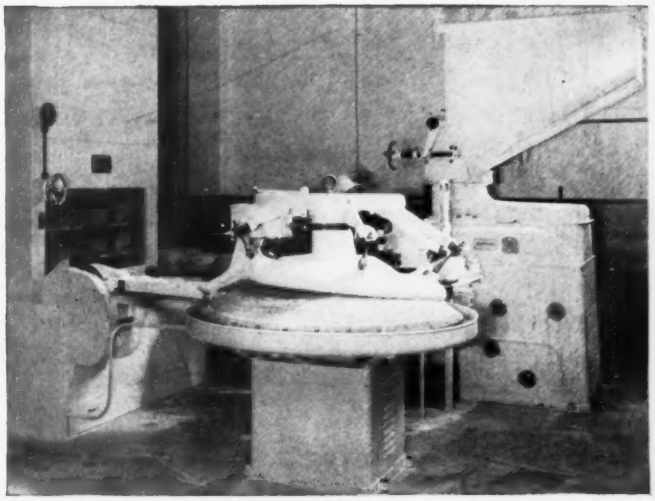
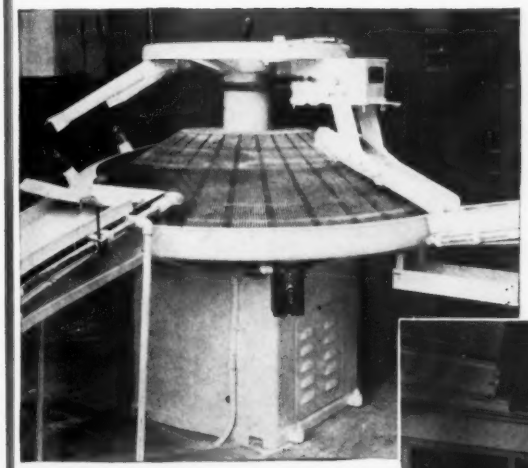


Fig. 7—Typical flow sheet showing sequence of machinery operations in bread manufacture; approximate temperatures, and methods of handling the product.

Courtesy of Baker Perkins, Inc.

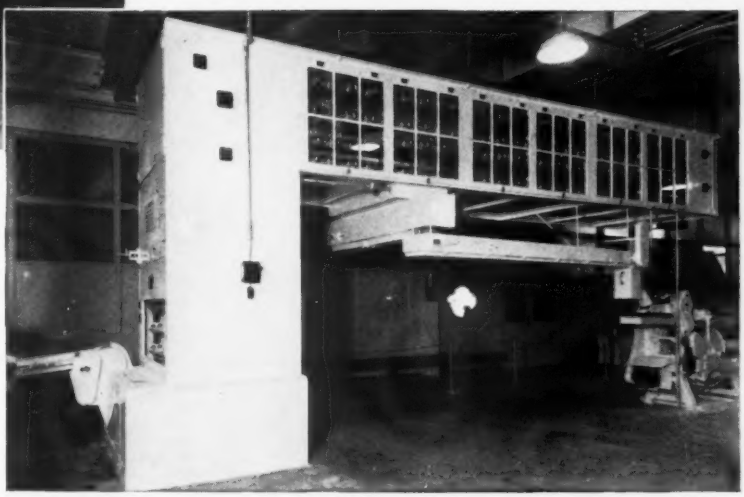
Fig. 8—Showing the installation of an 8-pocket divider with respect to a 60" loaf rounder and a double-lap proofer.





Courtesy of Baker Perkins, Inc.

Fig. 9—A 60" loaf rounder working in conjunction with a 6-pocket divider and 6-pocket proofer.

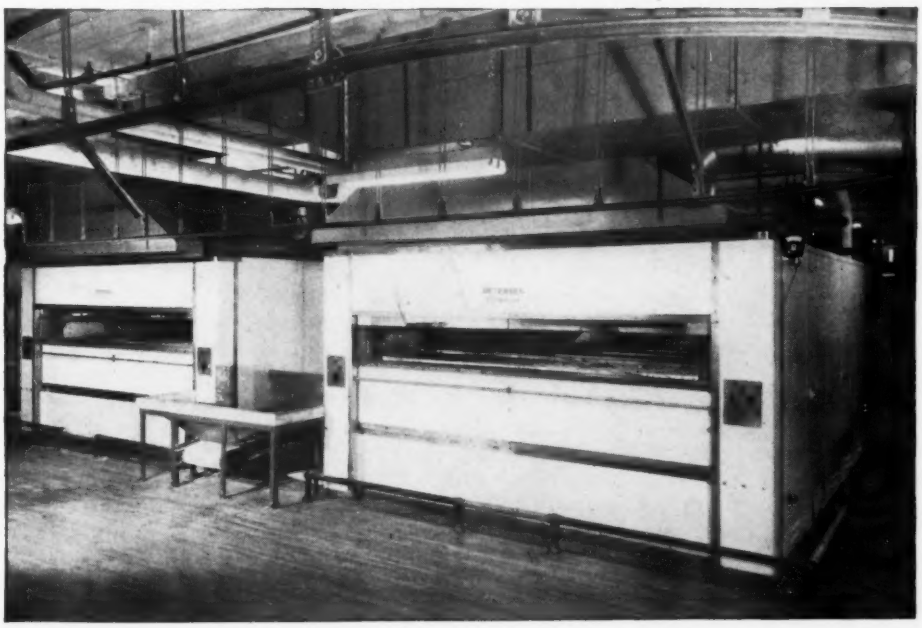


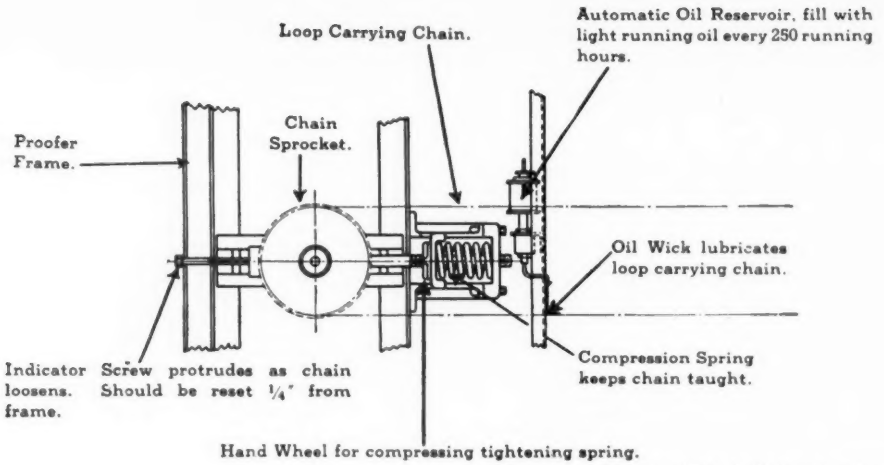
Courtesy of Baker Perkins, Inc.

Fig. 10—Side view of a 6-pocket 3½ panel loaf proofer.

Courtesy of The Peterson Oven Co.

Fig. 11—Showing the compactness of the modern traveling oven.





Courtesy of The J. H. Day Company

Fig. 12—Automatic chain tightener and oiler for the Day loop proofer.

texture. Ninety degrees Fahrenheit is considered as the proper temperature, with just enough humidity to prevent crusting. Under such conditions the desired proof is obtained in from 35 to 45 minutes. Heat and humidity are maintained by an air conditioning apparatus or by steam coils and a water container.

THE OVEN

Ever since man began to bake bread, the oven has been the basic element in the manufacture of bakery products. As the industry was developing, however, the oven frequently received but scant attention, in fact, there are still in use today, in remote localities, typical relics which differ very little from the old Roman types discovered in the ruins of Pompeii. Mechanization was at first not as applicable to the oven as it was to the divider, rounder, moulder and accessory handling equipment all of which were invented to speed up production and utilize labor more effectually.

Ultimately however, oven construction and operation caught up with the times. Batch baking could no longer keep up with improved preliminary operations; nor could dough that had been scientifically and accurately prepared be depended upon to maintain its weight and consistency, or receive the same extent of baking in crude, hand-fired ovens.

Hence the development of the modern automatic oven. Many variations were tried out, some of which have received marked attention due to their being suited for certain classes of work. Of these the revolving oven is a typical example, as being admirably suited for the smaller bakery, though it does still involve the principle of baking by batches. For continuous operation, however, the automatic traveling hearth oven is the most efficient machine for mass production.

In the traveling hearth oven the loaves are charged at one end onto an endless conveyor and carried at a slow, uniform rate of speed through the baking chamber. The rate of conveyor travel is such that, during this period, the loaves are completely baked, being discharged automatically from the opposite end of the oven. The first loaf in is naturally the first out; therefore, all remain in the oven practically the same length of time.

About 28 minutes is required to bake a one pound loaf, while 35 minutes is necessary for a pound and a half loaf. On the other hand, baking time can be definitely regulated from 15 minutes to 75 minutes by suitable variable speed transmission devices. In other words, speed of conveyor travel can be regulated as desired to suit requirements.

The temperature at the beginning of bread baking is about 390°F., being controlled to rise gradually to about 450°F., in the center of the oven, dropping from then on back to 390°F., at the discharge end. Temperature control is accurately maintained and measured periodically by pyrometers at regular intervals along the oven.

Heat is supplied from furnaces located above, below, at the side of the oven, derived from gas, oil, electricity or stoker-fired solid fuels. The principle of heated air through duct-work is used, suitable dampers being installed to regulate "top" and "bottom" heats as necessary. Traveling tray ovens have baking capacities from 1310 to 5680 lbs. of bread per hour, and Traveling hearth ovens from 1850 to 8000 lbs. of bread per hour. Many production bakeries operate ovens continuously for 12 hour periods.

SLICING AND WRAPPING MACHINERY

Slicing and wrapping quite naturally followed the trend in mechanization in the baking industry.

slicing as a matter of convenience for the consumer, wrapping to conform to modern advances in sanitation and public health. Modern practice combines the operations of slicing and wrapping in one machine with provision for moving the slicing unit out of operating position when it is desired to wrap whole loaves.

Slicing requires an installation of adjustable knives so arranged as to cut slices of uniform thickness. They are operated by cam or eccentric mechanisms, being held in rigid position by guides.

The wrapping machine is operated by an ingenious arrangement of cams, reciprocating motions, chain and sprocket mechanisms and carrier belts. The modern bread wrapper has been perfected to receive, wrap, seal and deliver as high as 3,400 loaves per hour with no handling. The only attention required is when the machine is to be lubricated or the feed or discharge are to be regulated.

LUBRICATION OF THE MIXER

Constructional details and the means provided by the manufacturers dictate how the mixer should be lubricated. The larger machines are practically all motor-driven equipped with gear or silent chain drives. Comparatively tight housings are used as a safety factor, to insure cleanliness and prevent dust-contamination of lubricants.

Gears and Chains

Gearing is lubricated according to the size, speed, load and tightness of the case. Normally, where cases are oil-tight, a specialty gear lubricant comparable in body to a heavy automotive gear oil is desirable. Where a heavier product is desired, usually involving hand application, the lubricant should possess excellent adhesive properties and not drip or be thrown off by centrifugal force. Hot application of this type of lubricant by means of a brush is general practice.

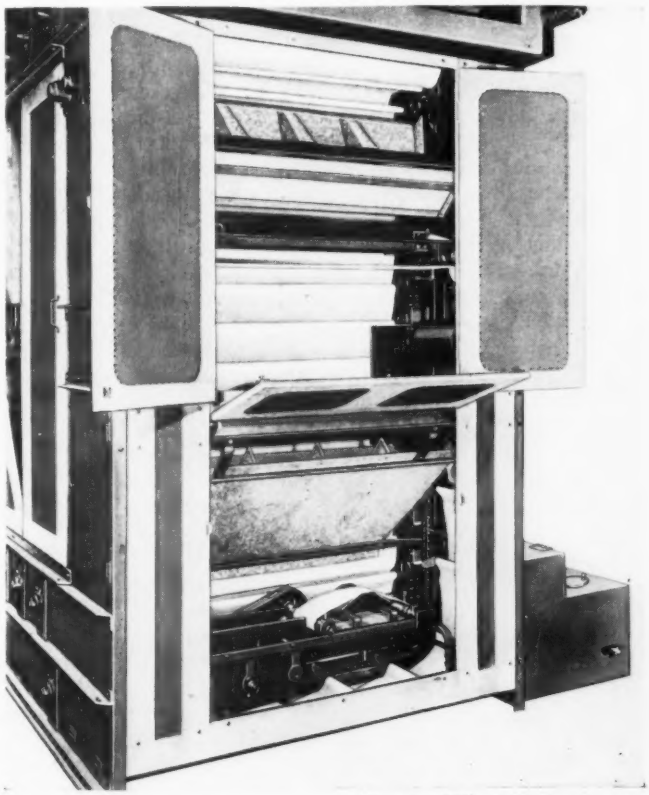
Driving chains can be efficiently lubricated by the same oil as is used for enclosed gears. In many cases, however, operators prefer to use a medium engine oil of 300 seconds viscosity at 100°F., feeding by means of a sight feed oil cup.

Bearings

Mixer bearings may be equipped with ring or chain oilers or with means for pressure grease lubrication. Where the trunnion bearings are of roller type they are grease lubricated. The ring or chain oiler in turn, requires an oil bath, this is positive in action and requires refilling of the reservoir only about every week or two, with complete cleaning about every three months. The operation of a ring or chain oiler can always be observed from the top bearing oil hole, and maximum economy in oil consumption is obtained. Since the bearings on the average mixer are subject to high pressure they require a fairly heavy, straight mineral oil of from 300 to 500 seconds Saybolt viscosity at 100°F. Prevention of contamination of the dough is most important. A suitable stuffing box arrangement on the mixing arm shaft usually will prevent any possibility of oil entering the mixer through the main bearing.

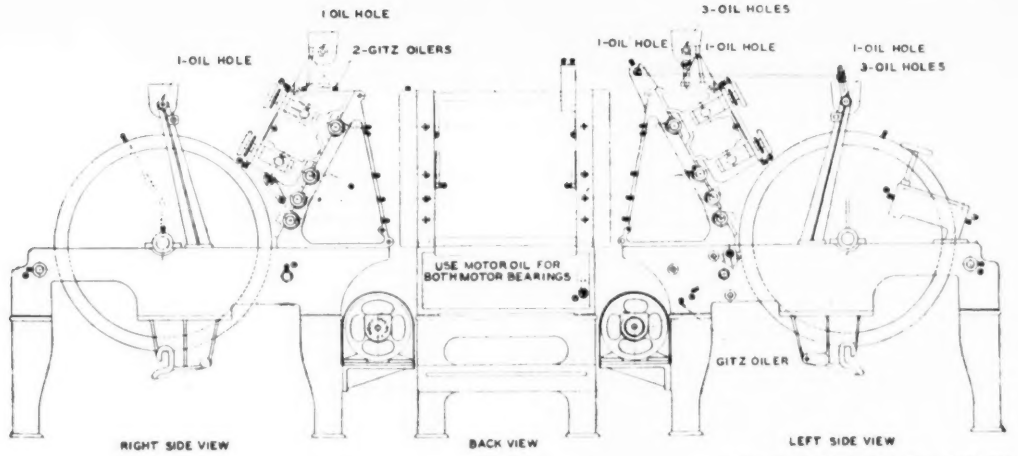
When the bearings are built for grease lubrication by means of compression grease cups or pressure gun, a carefully prepared medium consistency product should be used.

Electric motors may be ring oiled or equipped with ball or roller bearings. Ring oilers can be served with an oil such as mentioned above or of slightly lower viscosity. Ball or roller bearings, however, require careful study of bearing design and selection of a grease capable of maintaining



Courtesy of The J. H. Day Company

Fig. 13—Charging end of a Day vertical loop proofer showing part of the operating mechanisms.



Courtesy of The J. H. Day Company

Fig. 14—Lubrication chart for a Day "thorobred" moulder.

lubrication, preventing corrosion and remaining within the bearing elements. It is particularly important for the grease to resist leakage for if grease gets into the motor windings complete motor overhaul may become necessary.

LUBRICATING THE DIVIDER

The divider is probably the most difficult machine to lubricate in the baking industry. There the first handling of the finished dough takes place. Accordingly, the utmost care must be taken to prevent oil or grease from coming in contact with the product. Over-lubrication may be a cause of serious trouble; in contrast, considerable power losses may result from too little lubrication.

On all parts of the cutting mechanism, such as the knife edge, plungers and back of the division box, where there is possibility of the dough coming in actual contact with the lubricant, only the highest grades should be used, such as lard, cottonseed oil, refined petrolatum, or a tasteless, colorless, pure mineral oil. There should be maximum resistance to rancidity, gumming or reaction with sugar to affect the taste of the bread. This is why petrolatum or a tasteless, pure mineral oil is preferred.

General machine bearings, which are of sleeve design, can be well lubricated by a high quality machine oil of from 180 to 300 seconds Saybolt viscosity at 100°F. Electric motors, however, especially where equipped with anti-friction bearings, are usually grease lubricated. Ball and roller bearings on the divider should be lubricated with the same high quality grease as is recommended for electric motors.

Gears, chains or cam surfaces require a heavier straight petroleum lubricant, similar to the product suggested for enclosed gears on the mixer. Any such product should be applied sparingly to prevent throwing, and possible contamination of the dough, or soiling of the machine to necessitate frequent cleaning.

ROUNDER REQUIREMENTS

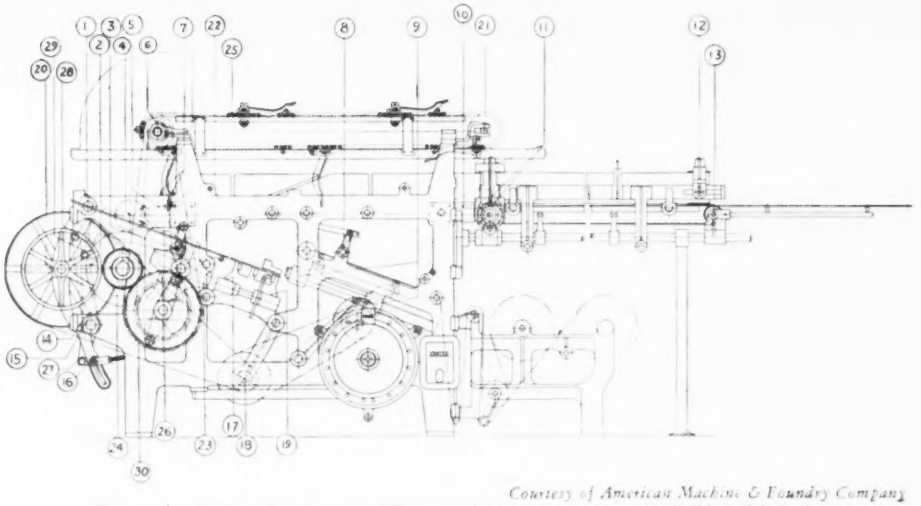
The rounder must be just as carefully lubricated as the divider. Rounder lubrication involves motor bearings, reduction gears, and spindle bearings. The first two points have been discussed under mixers, with suggestions as to suitable lubricants. Where worm reduction gearing is used, operating the gears in a bath of oil is generally best practice, using a highly refined compounded steam cylinder oil. Where spindle and other bearings are of the ball or roller type, a specially prepared grease, such as suggested for electric motors, should be used.

On sleeve-type bearings a straight mineral machine oil of from 180 to 300 seconds Saybolt viscosity at 100°F., applied by sight fed oil cups, will be suitable. Certain smaller sleeve bearings may require lubrication by means of pressure gun or grease cups; on these, a medium consistency pressure gun grease will be satisfactory.

PROOFER LUBRICATION

There is no particular problem involved in lubricating the automatic proofer. Pan-proofers normally require no lubrication. On the automatic proofer, the conveyor rolls are often equipped with wooden bearings; this means that only the motor bearings, the metallic bearings of the spacer, the main driving mechanism, and reduction gears require lubrication.

Motor bearings and gears are comparable to those on the mixer. The other bearings are usually designed for grease lubrication. In such service the conventional pressure gun grease is suitable. Certain types of automatic proofers, including those of the revolving shelf type, are equipped with roller or ball bearings on the main and auxiliary driving



Courtesy of American Machine & Foundry Company

Fig. 15—Lubrication chart for the AMF standard wrapping machine. See builder's lubrication chart for identity of numbered parts which are to be lubricated.

shafts. Lubrication, in such instances, is best attained by use of a specially prepared, medium consistency ball or roller bearing grease.

Over-lubrication of any such bearing must, of course, be prevented, otherwise drag, increase in power consumption and abnormal bearing temperature might result. The latter may promote grease leakage.

MOULDER LUBRICATION REQUIRES CONSIDERATION OF THE DRIVE

Moulder lubrication depends upon the type of drive. In general, motor drive to the rolls, via silent chains or belts, using a suitable speed reduction mechanism is the most common construction in such machines.

Gear and chain lubrication in turn has been discussed heretofore under Dividers and Mixers. Bearing lubrication is largely a matter of greasing, the parts being so designed as to present little or no possibility of the lubricant contaminating the dough. It is common practice to install grease cups or pressure grease fittings on moulder bearings, since they are relatively small and usually do not warrant automatic oiling devices such as rings or chains. The conventional pressure gun grease will be suitable for all such bearings.

OVEN CONDITIONS REQUIRE SPECIALTY LUBRICANTS

In the modern traveling oven lubrication is an important item. It is, in effect, one of the outstanding factors which will assure of dependable service. Should an oven have to be shut down, production would stop over the period of shutdown.

The rigid construction of the driving mechanism for the conveyor and the component parts of this latter is often deceiving, yet they all require quite as much attention from a lubricating viewpoint as any other machinery in the bakery. In operation, conveyor chain links, rollers, bushings and rods are subjected to most exacting service and normally are expected to run for indefinite periods.

High Temperature a Factor

Lubrication of such parts may become quite a problem, for the usual grades of machine oils will not stand up for any length of time under the temperatures involved. As a result, there is a tendency of some operators to give the matter up as a hopeless job, and neglect lubricating such parts entirely. It is practicable, however, to obtain lubricants of special refinement for this service. Wearing parts exposed to oven temperatures, for example, can be lubricated with a relatively light application of heavy mineral oil of low carbon residue content, or a special high temperature grease, that will not undergo sufficient reduction in body to drip or flow from the wearing parts. Many engineers, on the other hand, prefer to use a mixture of graphite and light mineral oil. The latter will naturally evaporate rapidly, but the graphitic residue is claimed to work its way into the rolls quite effectively to insure proper lubrication.

The conveyor driving mechanism, in turn, involves a problem of gear and bearing lubrication. Where gearing is exposed and operated at relatively slow speeds, a petroleum base gear oil of about 2000 seconds Saybolt viscosity at 210°F., furnishes an excellent and durable film of lubricant, which is resistant to dripping or throwing.

Bearings for gear shafts and conveyor sprockets may be of the ring or chain oiled type, or else of simple split bearing construction equipped with

sight feed oil cups. In either case a medium bodied engine oil of from 300 to 500 seconds Saybolt viscosity at 100°F., will meet the requirements. Where oil cups are provided, careful and periodic application is necessary.

On the Rotary Oven

The worm gear drives on the rotary or revolving type of automatic oven require a highly refined, compounded steam cylinder oil. Other parts of such ovens requiring lubrication should be studied as to construction and means of application. Normally, the products mentioned heretofore will serve the purpose satisfactorily.

LUBRICATING A SLICING AND WRAPPING MACHINE

There is no particular lubricating problem in the lubrication of such machinery. The main objective is to prevent oil or grease contamination of the product. As usually designed, slicing and wrapping machines are constructed for oil cup or pressure grease lubrication. The oil to use for such service should be a relatively light bodied straight mineral product of around 200 seconds Saybolt viscosity at 100°F. When a grease is called for, a highly refined light to medium consistency product will serve the purpose. Whatever the means available for lubrication, care should be observed to insure against splash or dripping of excess lubricant onto the bread or wrapping paper. Pressure grease cups, with means for indicating their grease content, have been adopted by certain builders, with a view to insuring positive lubrication with minimum waste or leakage.

MISCELLANEOUS EQUIPMENT

Other machinery in the modern bakery, such as conveying apparatus for handling the loaves, and specialty machines, including cake mixers, pie crimping machines, meringue mixers, etc., involve no specific lubricating problems. As a general rule, a good light bodied pressure gun grease, or medium viscosity straight mineral oil of from 200 to 300 seconds Saybolt will be suitable according to the means provided for application, — generally pressure gun or oil can.

CONCLUSION

In view of the importance that lubrication bears to the efficient operation of baking machinery, it can be readily appreciated that the utmost care should be observed both in the selection of lubricants and in their periodic application. As has been stated above, baking machinery involves the frequent possibility of contamination of the dough on account of dripped or leaked lubricants. The use of inferior, poorly refined, perhaps adulterated oils may easily result in the baker losing an entire batch of dough, or even becoming involved with the health authorities, to the certain detriment of his business. It will therefore be to his best interests to use the same judgment in the selection of his lubricants as in the selection of his other working materials; and to apply them to his machinery with the same care as observed in mixing his dough ingredients. Following the manufacturers' recommendation as to frequency and manner of re-lubrication is an excellent way to protect the machinery involved. Automatically this means reduced costs of maintenance.

USE THE PRESSURE GREASE GUN CAREFULLY

MANY of the bearings in the bakery are grease lubricated, the pressure gun being the predominating means of lubrication. When it is used with care, it is a most valuable piece of equipment. But if it is used carelessly, it can be the cause of a lot of headaches due to leakage of lubricants.

Remember the ball or roller bearings on baking machinery are generally built with a suitable seal to prevent leakage of lubricant. This protects the bearings, also the bakery products. Many bearing seals, however, are not infallible. Apply sufficient pressure and the seal may be broken.

This is just what happens when the pressure gun is used too freely. When an excess of grease is forced into a ball or roller bearing, it works past the seal and leaks out of the bearing. This is expected in some sleeve-type bearings — in fact it is indication that the bearing is completely lubricated. Don't assume however, that this same rule applies to a ball or roller bearing.

The ideal would be to keep such a bearing about half-filled with grease — over-filling causes drag, increased bearing temperatures and added power consumption. The mechanic or oiler in the average baking plant has no way of telling, however, just how much grease he is charging to the bearings, although a rough guess can be made by noting the rate of discharge of the particular type of lubricator he is using, and then timing its application. The average bearing on a moulder, rounder or wrapping machine doesn't need much grease, only about a spoonful at a time.

How often it should be regreased depends upon the seal. Well-sealed bearings can run for months without re-lubrication. Others require renewal of grease every two to four weeks. Practice varies in the baking industry. More often most of the machinery is over-lubricated by too zealous mechanics, or perhaps the wrong grade of grease is used. This is most apt to occur where two or more grades are stocked to conform with machinery builders specifications.

Normally, one grade, of N.L.G.I.* No. 2 consistency, having high temperature characteristics, refined to meet the requirements of ball and roller bearings, should lubricate staisfactorily all bearings in the plant, even the trunnion bearings on the mixers and the bearings of fans or motors set above ovens.

*National Lubricating Grease Institute.

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TEXACO LUBRICATION RECOMMENDATIONS FOR BAKING MACHINERY

FLOUR HANDLING EQUIPMENT

Bearings and Other Wearing Parts

Ring, Chain or Collar Oiled	Canopus Oil, or Nabob or Aleph Oil
Grease Lubrication — Pressure Type	Summitlube No. 1 Star Grease No. 1 or 2
Grease Lubrication — Compression Cup	Summitlube No. 3 Star Grease No. 2 or 3
Chains and Gearing	Crater No. 0

MIXERS

Gearing	Crater No. 1
Chain Belts	Thuban 140 or 629 Oil

Bearings

Ring, Chain or Collar Oiled	Canopus Oil or Aleph or Altair Oil
Grease Lubrication — Pressure Type	Summitlube No. 1 or 3 Starfak Grease L, M, or H Star Grease No. 1 or 3
Grease Lubrication — Compression Cup	Summitlube No. 3 Star Grease No. 2 or 3
Ball or Roller Type	Starfak Grease L, M, or H

DIVIDERS, ROUNDERS, PROOFERS, MOULDERS

Bearings

Ring, Chain or Collar Oiled	Canopus Oil or Nabob or Aleph Oil
Grease Lubrication — Pressure Type	Summitlube No. 1 or 3 or Star Grease No. 1
Grease Lubrication — Compression Cup	Summitlube No. 3 Star Grease No. 2, or 3
Ball or Roller Type	Starfak Grease L, M, or H
Gears, Chains, Cams, etc.	Crater No. 0 or Vega Grease No. 3
Worm Reduction Gearing	Cavis Cylinder Oil or, 650 T Cylinder Oil

OVENS (TRAVELING TYPE)

Conveyor Chain Links, Rollers, and Other Parts Subjected to High Temperatures	Regal Starfak No. 2
Gearing	Crater No. 2

Bearings

Ring, Chain or Collar Oiled	Canopus Oil or Aleph or Altair Oil

OVENS (ROTARY TYPE)

Worm Gearing	Cavis Cylinder Oil or 650 T Cylinder Oil

Bearings

Ring, Chain or Collar Oiled	Canopus Oil or Aleph Oil
Grease Lubrication — Pressure Type	Summitlube No. 1 or 2 Starfak Grease L, M, or H Star Grease No. 1 or 2
Grease Lubrication — Compression Cup	Summitlube No. 3 or Star Grease No. 2 or 3

WRAPPING MACHINERY

Bearings

Ring, Chain or Collar Oiled	Canopus Oil or Nabob or Aleph Oil
Grease Lubrication — Pressure Type	Summitlube No. 1 or 3 or Cup Grease No. 1 or 2
Grease Lubrication — Compression Cup	Summitlube No. 3 or Cup Grease No. ?
Lubrication of All Other Working Parts	Canopus Oil or Nabob Oil

MISCELLANEOUS EQUIPMENT

STEAM CHESTS, CONVEYORS, LOADING DEVICES, CAKE MIXERS, PIE CRIMPERS, MERINGUE MIXERS, CRUMB GRINDERS, CREAM PUFF FILLERS, ETC.

Bearings

Ring, Chain or Collar Oiled	Canopus Oil or Nabob or Aleph Oil
Grease Lubrication — Pressure Type	Summitlube No. 1 or 3 or Cup Grease No. 1 or 2
Grease Lubrication — Compression Cup	Summitlube No. 3 or Cup Grease No. 2 or 3
Other Working Parts	Canopus Oil or Nabob or Aleph Oil

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